REMARKS/ARGUMENTS

Claims 1-37 are resubmitted. Claims 1, 11, 19, 24, 25, 27-30, 31, and 33-35 are currently amended. No new claims have been added. No claims have been canceled.

Claims 1, 2, 4, 6, 9, 10, 25, 26, 31, and 32 have been rejected under 35 USC 102(b) as being anticipated by Koury, U.S. Patent 6,073,670 ("Koury"). Claims 1-6, 9-15, 17-21, and 23-35 have been rejected under 35 USC 103(a) as being unpatentable over Koury in view of the admitted prior art and either one of European Patent No. 198,744 or PCT WO 03/035380 optionally further taken with Ermert et al., the article entitled "R U Reinforcing Plastics with Robots?". Claims 7, 8, 16, 21, 22, 36, and 37 have been rejected under 35 USC 103(a) as being unpatentable over Koury in view of the admitted prior art and either one of European Patent No. 198,744 or PCT WO 03/035380 optionally further taken with Ermert et al. and further taken with Baxter Jr. et al., U.S. Patent 3,380,3675 and any one of Turner et al. (US 5,651,850), Reinman (US 3,141,806), Gaubatz (US 3,174,388), or Trimble (US 3,402,091).

Examiner Interview

A telephone interview was conducted between the Examiner and Applicant's representative on January 10, 2006. The references including Koury (US 6,073,670), Baxter (US 3,380,675) and Tisne et al. (EP0198744) were discussed. The Examiner indicated that amending the claims to recite application heads individually adjustable, relative to one another, would likely distinguish the known prior art, but that further search would be required. No other agreement was reached.

Koury

Independent claims 1, 11, 19, 24, 25, and 31 have been amended to recite application heads that are individually adjustable relative to each other and dynamically while material is being laid up as discussed during the Examiner Interview. Support for the amendments to the claims can be found in the specification, for example, at paragraphs [0011] through [0016] describing individual adjustability for each head, paragraph [0038] describing individual and independent adjustments for each head, paragraphs [0039] through [0041] describing types of adjustments in more detail including independently coordinated individual adjustability, and paragraphs [0046] -[0049], [0051], and [0052] reiterating aspects of individual adjustability of the material delivery heads.

While Koury discloses a machine with multiple material delivery heads suitable for laying material so long as the material is guided by channels (or grooves) in the mandrel, the multiple material heads are clearly "slaved" together (col. 3, lines 29-32; col. 4, lines 61-64), i.e., not individually adjustable relative to each other and certainly not individually adjustable relative to each other dynamically during the lay-up process, in contrast to the present invention as claimed. The Koury patent relies on the grooves to provide the final location of the material. The grooves form a mold which provides the permanent location of the material after cure. This allows for many of the simplifications in the Koury patent. By way of contrast the present invention provides no such limitations on the mandrel surface and does not rely on grooves to provide final location of the material. Each head is precisely controlled independently of the other heads in order to provide precise control of material laps and gaps within required specification limits.

For example, the Koury device would not be capable of building fuselage

skins even with simple and obvious additions of different heads. The nature of the plies that make up a fuselage skin, and the method of placing those plies are of much greater complexity than anything that the Koury patent is capable. A key difference is that the Koury patent relies on the existence of the grooves in the mold to define the final location of the material. Actually laying material onto a tool surface with sufficient tolerance to meet strict engineering requirements requires much more complexity than the Koury patent details. Laying onto a mandrel surface to form a continuous ply with complex ply boundaries is greatly different than laying material into grooves. An isogrid structure, which is what the Koury device is designed to fabricate, has a very repeatable pattern, where each pass is placed directly upon the previous pass. Once the machine is configured for the required orientations, no additional flexibility in the equipment is required. In fact, Koury teaches that all the heads do not move relative to each other. The only relative motion defined in the Koury patent is that the heads, as a unit, move relative to the mold or tool surface. Despite the fact that each head can be oriented for the correct angle, the inability to move each head relative to each other head makes it impossible to fabricate full plies.

The reason for this is that for a ply that covers a complex surface – such as a state-of-the-art commercial aircraft fuselage surface – each piece of tape follows a slightly different path relative to adjacent tapes. Also, the surface normal along the tape centerline varies significantly from adjacent tapes. Each delivery head must follow the surface normal defined for the tape path. For each head to follow a particular tape path's surface normal along the path, specific head axis movement is required. Since each path is different than any other being placed at the same time, each head must move somewhat independently of each other head. In contrast to the present invention as claimed, Koury's patent does not allow this to happen.

Also for example, the layup surface of a fuselage surface – such as those capable of being laid-up by the present invention – is not a simple surface. Even though the outer surface may be smooth, the cross section contour is not exactly circular, but is rather an arrangement of multiple circular segments joined by tangent arcs that results in a somewhat oblong oval shape. Additionally, the skin thickness varies greatly depending location on the barrel and particular load conditions. Skin gauges can change from as low as 10 plies to over 90 plies in localized areas. With a smooth outer surface required for aerodynamic reasons, all skin gauge changes push to the inner surface. Transitions between different gauges are accomplished by 20:1 ramps which results in about 2 degree variation in surface normals. The ramp ratio of 20:1 means that the ramp feature is 20 times longer than the change in the skin thickness. Tape paths on all but the very outer plies of the fuselage must navigate across the complex, non-circular, ramped surfaces of varying degrees.

One effect of the ramps is that when a piece of tape hits the ramp surface, the natural path of the tape to fold over the ramp can form large gaps, on the order of an inch or more, between an adjacent piece of tape that may pass across a slightly different ramp section – as in corner details. In general, gaps exceeding .050 inch between adjacent pieces of tape are unacceptable. For this reason, each piece of tape must be steered, within limits, to maintain a continuous ply free of gaps that exceed specification limits. Again, since each piece of tape has a slightly different requirement for steering, each delivery head must move relative to each other delivery head when laying tape to ensure that the ply quality meets specification.

The Koury patent, in contrast to the present invention as claimed, does not provide for a means to move each head relative to each other head that would be required in order to meet strict process specifications for gaps and overlaps between adjacent pieces of tape.

Furthermore, it would not be effective to combine Koury with any other reference by replacing the plurality of heads of Koury with different heads in order to achieve the results of the present invention. More specifically, the delivery heads defined in the Koury Patent would not work for plies (on a fuselage as discussed above) whether full or partial (doubler) plies. In fact it appears that the heads as described in the Koury patent might not function at all. The method of starting the laydown of a piece of material is by using a "grabber means" or roller (48) (col. 5, line 3) that is completely undefined in the patent. This is a key function of the head, but no plausible solution is given for the grabber roller, particularly a roller that grabs the material for only about 160 degrees around, and then suddenly releases the material once it touches the tool. An important consideration in Koury is that the material is cut "either at the end of the channel or even beyond the channel (col. 5, lines 31-32). Claim 5 describes the cutting as a "means for cutting said fiber means *after* placement thereof in a channel" (emphasis added). Assuming that channels are equivalent to tape on a fuselage surface as the Office action described, only full plies of a fuselage would fit this description. On a typical fuselage, 8 full plies are placed through automated means. For these plies, the ends of the tape (either cut or started) are located outside of the end of the part. The rest, of the sometimes over 90 plies, all have ply boundaries that start and stop within the limits of the part. In most cases, these ply shapes are very complex. Figure 1 (see Information Disclosure Statement, filed herewith) illustrates two types of doublers, both complex integrated doublers and isolated individual doublers. Koury's patent does not address this level of complexity. Derivatives of the delivery heads of Koury are certainly not capable of placing material fabricating this level of complexity.

While other references may show single lay-up heads that are adjustable it cannot be said that - even if obvious to provide multiple heads to speed

productivity - it would be obvious to provide for multiple individual adjustability of the level of complexity claimed by the present invention because the multiple heads of Koury are not individually adjustable, while a single adjustable head does not even raise the question of adjustability relative to other heads. Thus, it would not be proper to combine any other single head reference (e.g., Tisne, etc.) with Koury to assert obviousness of the present invention over Koury.

Thus, it is believed that the claims as amended are now in condition for allowance and that the 35 USC 102 and 103 rejections should be withdrawn.

Prior art made of record and not relied upon

Applicants respectfully submit that neither of the references Bendarzewski et al. (US 4,946,538) and Cahuzac et al. (US 5,645,677) teach a plurality of individually adjustable material delivery heads (individually and independently adjustable relative to each other and relative to the mandrel surface during the lay-up process) as claimed by the present invention.

CONCLUSION

Applicants would like to thank the Examiner for the telephone interview of January 10, 2006. Reconsideration and withdrawal of the Office Action with respect to claims 1-37 is requested.

In the event the examiner wishes to discuss any aspect of this response, please contact the attorney at the telephone number identified below.

Respectfully submitted,

By: /David Bowls/
David Bowls, Reg. No. 39,915
Michael A. Shimokaji, Reg. No. 32,303

SHIMOKAJI & ASSOCIATES, P.C.
8911 Research Drive
Irvine, CA 92618
(949) 788-9961

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to:

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

on Jan. 17, 2006

/David Bowls/
David Bowls, Reg. No. 39,915
Michael A. Shimokaji, Reg. No. 32,303